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occidentalis). Many rodent remains are present, notably those of *Aplopontia*.

The fauna, so far as known, differs from that of the Shasta caves in the absence of the peculiar goats, *Euceratherium* and *Preptoceras*, and of the deer. As far as our knowledge goes at present, the split bones so numerous in the northern caverns are relatively scarce in Hawver Cave. A fuller collection will throw more light on this point, and will give us a better knowledge of the relation of this fauna to that of other caves in this state.

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CURRENT NOTES ON LAND FORMS

CHANGES OF LEVEL IN YAKUTAT BAY

THE deformed shorelines of the Yakutat Bay region in Alaska as described by R. S. Tarr and L. Martin in 'Recent Changes of Level in the Yakutat Bay Region' (*Bull. Geol. Soc. Amer.*, XVII., 1906, 29-64) reveal recent and extraordinarily rapid and great changes in land level. The region is one whose general features were already known through the studies of Russell (1890) and Gilbert (1899), both of whom include mention of the precipitous shores in their general descriptions.

In September, 1899, three months after the Harriman expedition, of which Gilbert was a member, a series of violent earthquakes occurred in Alaska. The shocks are now found to have been associated with displacements that produced uplifts of from seven to ten feet on the southeast and of from forty to forty-seven feet on the northwest side of Yakutat Bay. The uplifts seem to have occurred within a little over two weeks and mainly on a single day, September 10, 1899. There were movements in other parts of the region besides Yakutat Bay, but to a less extent, and in some cases there was depression instead of elevation.

The physiographic effects of uplift are clearly preserved in the form of elevated beaches with fans and deltas of moderate size in bays, and of elevated narrow rock benches

with sea caves and chasms cut in the headlands. Several new reefs and islands have appeared in consequence of the change of level. In some localities the elevated beaches are as clearly preserved as if they were merely exposed at low tide; elsewhere they have been partly dissected, the degree of preservation varying with height above present tide, position with respect to drainage from the land, and effectiveness of present wave attack. At almost every stream mouth there is an elevated fan or delta, its front nipped away by wave action after uplift and its top dissected by the now intrenched stream. In some cases the frontal nipping has been checked by new deltas built seaward from the new shoreline. The amount of land gained from the sea is very small in consequence of the former steep submarine slope imposed by previous glacial erosion upon mountain sides that may have been initially steep from faulting. It is evident that even the pre-earthquake stage of shore-line development was very little advanced, so small was the modification of land form along the line of sea action: the post-earthquake development is perceptible only on loose material; the rock slopes do not yet appear to be cut at the new water level.

I. B.

THE TIAN SHAN PLATEAU

RECENT explorations of the Tian Shan Mountains of north-central Asia have shown that a considerable part of their area consists of highlands of moderate relief, locally known as Syrt, at an altitude of 3,000 or 4,000 meters, above which various mountains rise and beneath which numerous valleys are deeply entrenched. The rocks of the highland are for the most part granites and other crystallines or deformed Paleozoic strata, across which the highland surface passes indifferently; but Tertiary deposits occur here and there, and the higher areas bear signs of glaciation. One of the first explorers to give an appreciative account of the plateau-like highlands was M. Friederichsen, now of Göttingen, who in 1902 accompanied Saposnikof, botanist of Tomsk, into the district west of Khan Tengri, the great dominating summit

of the region, and southeast of (Lake) Issik-kul, where the Syrt is well developed. In his 'Forschungsreise in den zentralen Tiën-schan und Dsungarischen Ala-tau' (a work of 311 pages constituting volume XX., *Mitt. Geogr. Gesellsch. Hamburg*, 1904; see pp. 87, 91, 121), he describes several gently rolling, grass-covered highlands, the flatness of which surprised him; but he gives no explicit explanation of their origin other than referring them to an 'apparently long period of continental development' (p. 157) without specifying the conditions which subsequently brought about their deep dissection. Similar surfaces of degradation, now slanting at such inclination



FIG. 1. The Ishigart range in the Tian Shan, from photograph by Friederichsen (*Pet. Mitt.*, 1906, Heft III.).

as to be sharply dissected by narrow valleys, are described (pp. 198, 206) by the same author in various mountains—or blocks, as one might say—of the Ala-tau, the northern outlying members of the Tian Shan system, but again without explicitly explaining why the earlier process of even degradation had been followed by sharp dissection (p. 216). In another article ('Beiträge zur Morphologie des centralen Tiën-Schan,' Verh. XIV., Deut. Geogr'tages, 1903, 35-42) Friederichsen briefly considers the possibility of dislocation of the degraded surfaces, preliminary to their dissection.

In 1903, E. Huntington crossed the Tian Shan from Issik-kul to Kashgar, and described the highlands as parts of an uplifted and partly dissected peneplain ('A Geologic and Physiographic Reconnaissance in Central Turkestan,' in Pumpelly's 'Explorations in Turkestan,' Carnegie Inst., pub. No. 26, 1905, 159-216; see pp. 167, 171), an opinion in which the undersigned fully concurred ('A Journey Across Turkestan,' *Ibid.*, 28-119; see p. 73; also 'A flat-topped range in the Tian

Shan,' Appalachia, X., 1904, 277-284). Parts of the same peneplain were believed to be recognizable in the even back-slope of several isolated ranges near Issik-kul, which were explained as tilted fault-blocks; and again farther north in the still low-lying Siberian steppe, degraded to small relief on crystalline and deformed stratified rocks in the neighborhood of Semipalatinsk.

W. M. D.

MERZBACHER'S TIAN SHAN EXPEDITION

A MUCH more detailed exploration of the Tian Shan, especially around Khan Tengri, was carried on by Merzbacher's expedition in 1902-3, of which the fuller reports are now publishing; but neither in his preliminary report (*Pet. Mitt. Ergänz'hft*, 149, 1904; also 'The Central Tian Shan Mountains,' London and New York, 1905) nor in a recent descriptive article ('Der Tian-Schan oder das Himmelsgebirge,' *Zft. D. und O. Alpenver.*, XXXVII., 1906, 121-151; excellent photographs) does this explorer give particular account of the Syrt, not even to the remarkable slanting table-top of Mt. Catherine (Fig. 2); his attention being chiefly directed to the grand massif of Khan Tengri and its great system of radiating glaciers. However, his geologist, H. Keidel, in a report on the sci-

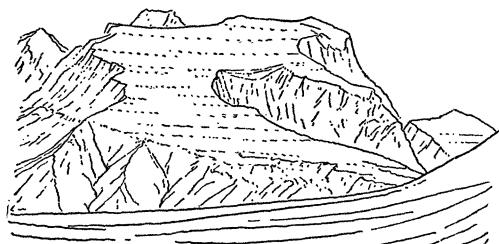


FIG. 2. Mt. Catherine (about 19,500 ft.), from photograph by Merzbacher, taken on Ak-bel Plateau (13,000 ft.), Tian Shan (The Centr. T. S. Mtns., plate opp. p. 177).

tific results of the expedition ('Geol. Übersicht über den Bau des zentralen Tian-Schan,' *Abh. k. Bayer. Akad. Wiss.*, II. Kl., XXIII., 1906, 91-192), makes it clear that the highlands of the Syrt, with their astonishing evenness of surface, are the result of Mesozoic (and early Tertiary ?) degradation of a pre-

viously deformed and folded mountain system; and that their present attitude and dissection are due to Tertiary faulting and vertical displacement, the surface margins and slope of the faulted blocks being indifferent to the general geological structure of the region.

As to the altitude of these surfaces of degradation before their sub-recent displacement, several opinions are held. Friederichsen suggests that they originated in interior basins, unrelated to the general baselevel of the ocean, and hence that their present altitude need not differ so very greatly from the altitude in which they were degraded (*Pet. Mitt.*, I., 1904, 272-273). Keidel explicitly states that it is as yet undetermined whether the present relief of the highland is due to elevation of the degraded masses or to sinking of the surrounding region. The undersigned has expressed the opinion that the even surfaces of degradation are uplifted members of a once far-extending peneplain, which bore residual mountains and mountain groups here and there; the best-finished part of the peneplain being seen still in or near its attitude of degradation in the neighborhood of Semipalatinsk, while other parts farther south have been faulted, uplifted and tilted in blocks of various areas, altitudes and attitudes ('The Bearing of Physiography upon Suess's Theories,' *Amer. Journ. Sci.*, XIX., 1905, 265-273). Hence, according to the second and third of these views, it would appear that the Tian Shan, like various other mountains, must be withdrawn from the class of forms whose present altitude, in relation to their surroundings, is due to crustal compression.

W. M. D.

THE SYSTEMATIC STUDY OF MOUNTAINS

THE systematic study of mountain forms in accordance with the scheme of the physiographic cycle has presented difficulties, because it has so seldom been possible to reconstruct with any fair degree of success the forms initiated by deformation, on which the sequential forms are then to be developed in due order by the processes of erosion. Substantial relief from this difficulty is promised

in all those cases, now increasing in number yearly, in which mountains are shown to be not in the original cycle initiated by disorderly compression and folding, but in a later cycle, initiated by uplift or by relatively simple block faulting, after more or less advanced peneplanation in a previous cycle. The systematic treatment of such mountains is relatively easy; for if they are not too much dissected the essential features of their initial forms may be easily determined and apprehended; and their sequential forms are in the main equally within the reach of explanatory description. If to this be added the recent increase in the understanding of high-mountain sculpture by glaciers, first clearly generalized by Richter and later presented in much detail for the Alps by Penck and Brückner, the possibility of developing a systematic method of mountain description does not seem so remote as it did a few years ago.

W. M. D.

SCIENTIFIC NOTES AND NEWS

COLONEL W. C. GORGAS, chief sanitary officer of the Isthmian Canal Commission, has been appointed by President Roosevelt a member of the commission.

PROFESSOR SIMON NEWCOMB has been elected honorary fellow of the Physical Society of London.

THE steam yacht *Virginia*, on which Mr. Alexander Agassiz was making explorations in the West Indies, struck a submerged wreck on February 11, and was obliged to go to San Juan under sail, where it was placed in dry dock.

PROFESSOR T. W. RICHARDS, of Harvard University, will sail for Germany on March 9, in accordance with the arrangements for an exchange of professors between Harvard University and the University of Berlin. Professor Richards will lecture on 'The Fundamental Constants of Physical Chemistry.' A laboratory has been fitted up for Professor Richards by Dr. Arthur Staehler, who last year worked with him at Harvard University.